zontal arms. Previously to the fixing of the cork siphon­tube in its place, a membra­nous tube, formed of a part of the gullet of an ox, is drawn through the lower collar, *e f* and fastened with twine to the upper, *l m n o;* and when tightly fixed by the cork below, forming an internal cavity to the cell, communicating with the siphon-tube in such a way as that, when filled with any liquid to the level *m o,* any addition causes it to flow out at the aperture *k.* In this state, for any number of drops allowed to fall into the top of the cavity, an equal num­ber are discharged from the bottom, *p q,* is a rod of

cast zinc, amalgamated with mercury, six inches long and half an inch diameter, supported on the rim of the upper collar by a stick of wood, *r*, *s*, passing through a hole drilled in its upper extremity ; *t* is a small cup for the re­ception of mercury, by which, and the cavity *a*, at the top of the zinc rod, various connexions of the copper and zinc, of the different cells, may be made by means of wires pro­ceeding from one to the other.

In fig. 33 the ten cells are represented as connected in

single series, the zinc of one with the copper of the next. They stand upon a small table in a circle, with the apertures of the siphon-tubes turned inwards, surrounding a large fun­nel, communicating with the basin underneath, for the re­ception of any liquid which may overflow. A smaller fun­nel is supported over the internal cavity of each cell by a ring sliding upon rods of brass placed between each pair of cells. One of these only is shown in the drawing to avoid the crowding of the sketch.”

In the preceding construction, Mr Daniell had two main objects in view. 1. To remove out of the circuit the oxide of zinc as soon as its solution is formed ; and, 2. To absorb the hydrogen evolved upon the copper without pre­cipitating any substance injurious to the latter. The *first* of these objects is completely effected by suspending the rod in the membranous cell, into which fresh acidulated water is allowed to drop slowly from the funnel above, whi1st the heavier solution of the oxide is withdrawn from the bottom at an equal rate by the siphon-tube, *g h i j k.* The *second* object was attained by charging the space round the membrane with a saturated solution of sulphate of copper instead of dilute acid. When the circuit was com­pleted the current passed freely through this solution, no hydrogen appeared upon the conducting plate, but a beau­tiful thick coating of pure copper was precipitated upon it, thus perpetually renewing its surface.

Notwithstanding these charges, there was still a gra­dual, though very slow, decline in the force of the battery, which Mr Daniell traced to the weakening of the saline solution by the precipitation of the copper, and consequent decline of its conducting power. In order to remedy this defect, he suspended some solid sulphate of copper in small muslin bags, which just dipped below the surface of the solution in the cylinder, and kept it in a state of satu­ration by its gradual dissolution. With this improvement the voltaic current became perfectly steady for *six* hours together. An improvement upon this arrangement is shewn in fig. 34, where *a c f h,* is a perforated colander of copper, into which, instead of muslin bags, the sul­phate of copper is placed. The central collar, *b d e g,* rests by a small ledge upon the rim of the cylinder. The membrane is then drawn through the collar, and, after being turned over its edge. It is fastened with twine.

Professor Daniell having found it of great advantage to increase the num­ber of cells, he now places them in two parallel lines, of ten each, upon a long table, the siphon-tubes being disposed opposite each other, and hanging over a small gutter, placed between the rows to carry off the refuse solution when the acid requires to be changed ; and as a uniform action may be kept up by occa­sionally adding a small quantity of fresh liquid, he now dispenses with the dripping funnels.

Professor Daniell considers a battery of twenty cells as amply sufficient for all the purposes of demonstration and investigation. It keeps eight inches of platinum wire, 1/100th of an inch in diameter, permanently red hot in the open air, and it is even an economical source of the purest oxygen for laboratory purposes. For this latter purpose he has fitted up a cell by inclosing a platinum plate, in­stead of the zinc rod, within the membranous tube, which is closed at the upper end by a glass tube bent in a con­venient form to deliver the disengaged gas under a receiver. When this cell is included in the circuit of double cells, the hydrogen is absorbed as formerly by the oxide of copper, but the oxygen is evolved from the platina at the rate of eighty-four cubic inches in the hour.

In a subsequent paper on voltaic combinations@@1 Profes­sor Daniell found that the power of the battery was great­ly increased by an increase of temperature. Having dis­solved the sulphate of copper in standard acid, in place of water, the battery produced thirteen in place of eleven cubic inches of mixed gases every five minutes. On another occasion, he added one part of sulphuric acid to eight parts of the saturated solution of the sulphate, and poured it into the cells, when of the high temperature pro-

@@@, Phil. Trans, vol. xxxvii. p. 119, &c